## UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY

# GEOPHYSICAL AND LITHOLOGIC LOGS FOR THIRTEEN HOLES DRILLED IN THE BOOK CLIFFS COAL FIELD, RANGE CREEK AND WOODSIDE QUADRANGLES, EMERY COUNTY, UTAH

Ву

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This report has not been edited for conformity with U.S. Geological Survey editorial standards or stratigraphic nomenclature.

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GEOPHYSICAL AND LITHOLOGIC LOGS FOR THIRTEEN HOLES DRILLED IN THE BOOK CLIFFS COAL FIELD, RANGE CREEK AND WOODSIDE QUADRANGLES, EMERY COUNTY, UTAH

By Howard F. Albee

#### INTRODUCTION

Thirteen holes, for a total of 15,475.5 feet, were rotary drilled, and five of them were partially cored, in the Book Cliffs coal field, Utah, for the U.S. Geological Survey in October 1978. An additional hole, BC-5-RC, was begun in T. 17 S., R. 15 E., sec. 22, but was abandoned at 750 feet.

The drilling was done by Himes Drilling Company of Grand Junction, Colorado, under contract no. 14-08-0001-17342, awarded by the USGS. The geophysical logging was done by Strata Surveys, Steamboat Springs, Colorado. Permission to drill was granted by officials of the U.S. Bureau of Land Management, Price, Utah.

The purpose of the drilling was to obtain information on the thickness, quality, and extent of coal, and the lithology of the enclosing rocks, in the Upper Cretaceous Blackhawk Formation. The overall goal of the project is to evaluate and classify Federal lands in the public domain.

Drilling was done in the Range Creek and Woodside quadrangles, Emery County, Utah, using truck-mounted rotary drilling and coring rigs. Drilling media were air and foam for the rotary drilling and mud for the coring. Coring was done only in the upper coal-bearing member of the Blackhawk Formation.

All drill holes were logged by geophysical methods which included resistivity, natural gamma, density, and caliper. The logs were run at a scale of 1 inch to 10 feet; but for this report they were reduced to 1 inch to 50 feet.

All measurements are in feet; to convert to meters, multiply by 0.3048.

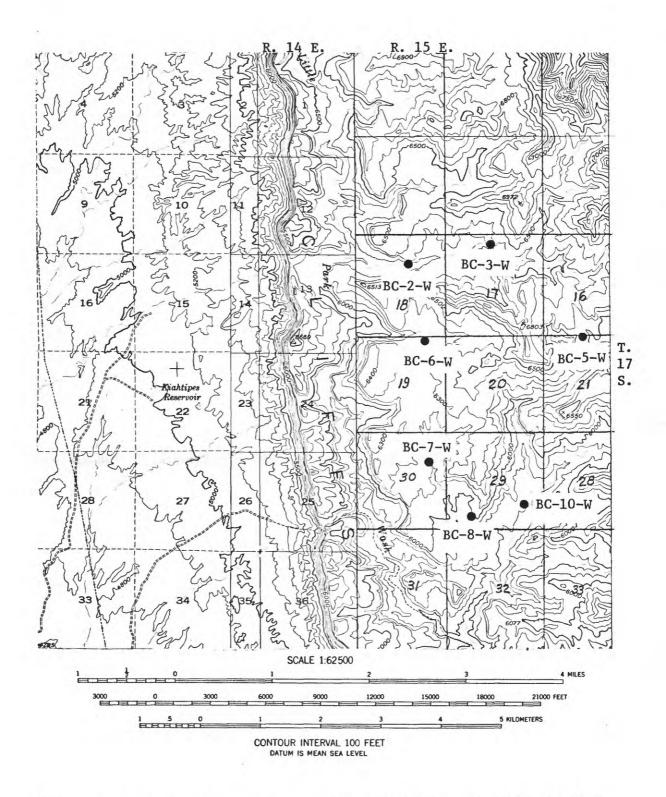


Figure 1.--Drill-hole locations in the Book Cliffs coal field, Woodside quadrangle, Emery County, Utah.



Figure 2.--Drill-hole locations in the Book Cliffs coal field, Range Creek quadrangle, Emery County, Utah.

**BLACKHAWK FORMATION OF MESA-**VERDE GROUP (UPPER CRETACEOUS): TKfn FLAGSTAFF LIMESTONE (EOCENE(?) Kbs Upper mudstone member and Sunnyside AND PALEOCENE) AND NORTH HORN Member - Upper mudstone member; mud-FORMATION (PALEOCENE AND UPPER stone and discontinuous sandstone, siltstone, CRETACEOUS) - Interbedded siltstone, and claystone of continental and marine sandstone, mudstone, and limestone; inorigin; Sunnyside coal bed at base. Sunnydividual lithologic units mostly thin and side Member: arenaceous siltstone and lens shaped; form gentle slopes and ledges. very fine grained to medium grained sand-Deposited in lakes and flood plains; limestone, grading downward from coarser to stone beds locally very rich in invertebrate finer; forms abrupt cliff (middle part of fossils. Thickness 500-800 feet Book Cliffs); sharp upper contact and PRICE RIVER FORMATION OF MESAVERDE transitional lower contact. Thickness of GROUP (UPPER CRETACEOUS): entire unit 150-350 feet Kpb Bluecastle Sandstone Member - Fine- to Lower mudstone member and Kenilworth Kbk medium-grained sandstone, a single bed Member - Lower mudstone member: mudcomposed of fluviatile channel-fill deposits; stone and discontinuous siltstone, sandforms abrupt cliffs and ledges. Thickness stone, and claystone of continental and 75-250 feet marine origin; Rock Canyon coal bed at Mudstone member - Interbedded and dis-Kpm base. Kenilworth Member: arenaceous continuous mudstone, siltstone, and sandsiltstone and very fine grained to medium stone, mostly dark gray to dark brown; ... coarser to finer; composed of three distinct forms slopes and low ledges. Locally consandstone beds, each separated by darktains vertebrate fossils. Thickness 100gray mudstone and siltstone; forms lower 400 feet part of Book Cliffs; upper contact sharp, CASTLEGATE SANDSTONE OF MESAlower contact transitional. Thickness of Kc entire unit 150-300 feet VERDE GROUP (UPPER CRETA-CEOUS) - Fine- to medium-grained sand-Kba Lower tongue of Aberdeen Member - Very stone, local concentrations of clay galls at fine grained sandstone, siltstone, and clayvarious horizons; forms high, abrupt cliff stone containing much carbonaceous debris; and bare sandstone dip slopes. Thickness forms low cuesta a few hundred feet below 80-300 feet the base of the Book Cliffs within the Mancos Shale outcrop. Thickness 0-50 feet

Figure 3.--Description of rocks in the Woodside and Range Creek quadrangles, Emery County, Utah. (Modified from Osterwald and Maberry, 1974.)

#### REFERENCES

- Fisher, D. J., Erdmann, C. E., and Reeside, J. B., Jr., 1960, Cretaceous and Tertiary formations of the Book Cliffs, Carbon, Emery, and Grand Counties, Utah, and Garfield and Mesa Counties, Colorado: U.S. Geological Survey Professional Paper 332, 80 p.
- Osterwald, F. W., and Maberry, J. E., 1974, Engineering geologic map of the Woodside quadrangle, Emery and Carbon Counties, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-798, scale 1:48,000.

Table 1.—Summary of information for thirteen holes drilled in the Book Cliffs coal field, Range Creek and Woodside quadrangles, Emery County, Utah

[FEL, from east line; FWL, from west line; FNL, from north line; FSL, from south line. All measurements in feet; to convert to meters, multiply by 0.3048]

Drill- hole No.	Location	Rotary drilled depth	Cored interval	Depth logged	Total depth
BC-3-RC	T. 17 S., R. 16 E., sec. 4 700 FEL, 1,900 FSL	1,700		1,691	1,700
BC-4-RC	T. 17 S., R. 16 E., sec. 22 1,000 FWL, 2,050 FNL	1,122.3	1,122.3- 1,272.6	1,270	1,272.6
BC-6-RC	T. 17 S., R. 15 E., sec. 23 300 FSL, 2,000 FEL	3 1,595		1,595	1,595
BC-7-RC	T. 17 S., R. 16 E., sec. 30 300 FSL, 1,200 FEL	931	931- 1,083	1,081	1,083
BC-8-RC	T. 17 S., R. 16 E., sec. 33 700 FWL, 200 FNL	3 1,020		1,019	1,020
BC-9-RC	T. 17 S., R. 16 E., sec. 27 950 FWL, 1,950 FNL	7 1,224		1,222	1,224
BC-2-W	T. 17 S., R. 15 E., sec. 18 1,500 FNL, 2,100 FEL	3 740		738	740
BC-3-W	T. 17 S., R. 15 E., sec. 15 350 FNL, 2,100 FWL	955.7	955.7- 1,212	1,212	1,212
BC-5-W	T. 17 S., R. 15 E., sec. 21 100 FNL, 2,200 FWL	1,750		1,722	1,750
BC-6-W	T. 17 S., R. 15 E., sec. 19 450 FNL, 700 FEL	759.4	759.4- 961.8	961	961.8
BC-7-W	T. 17 S., R. 15 E., sec. 30 900 FEL, 1,450 FNL	985		984	985
BC-8-W	T. 17 S., R. 15 E., sec. 29 700 FSL, 1,200 FWL	771.3	771.3- 942	942	942.1
BC-10-W	T. 17 S., R. 15 E., sec. 29 700 FSL, 1,150 FEL	990		984	990

### U.S. GEOLOGICAL SURVEY DRILL-HOLE LOG, EMERY COUNTY, UTAH

Hole No.	BC-3-RC Quadrangle Range	Creek		Elevation	5,250	ft
Location:	T. 17 S., R. 16 E., sec. 4	, 700	FEL :	1,900' FSL		ì
Rotary-	Cored interval	L	ogged			depth <u>1,70</u>
Geophysic	al logs:					
Cali	per (Cal) - Logging speed: ft/min	. Ot	hers:	20. ft/mi	n	
	stivity (Res):		ale:		7	
Gamm	a (Gam): T.C. $\underline{2}$ sec.	Sc	ale:	15 cps/	log div.	_
Dens	ity (Den): T.C. 1 sec.	Sc	ale:	62.5 cps	/log div	<u>.</u>
Remarks:	Caliper and resistivity logs not run	n		<del>-,</del>		
And the state of t		7		GEOPHY	SICAL LO	GS
	LITHOLOGY	STRIP	Gam	Den	Cal	Res
0- 60	) Alluvium					
aı	tart drilling in Flagstaff Limestone and North Horn Formation, addifferentiated					
60- 65	Limestone, gray, silty, impure			50'		
65- 80	Limestone, gray, hard, fairly pure			>		
80- 110	Mudstone, gray, soft				}	
110- 130	Mudstone, gray, grading to fine siltstone				\$	
130- 160	Mudstone, maroon to reddish-brown, very soft; shale, white			100		- F
160- 170	Mudstone and shale, variegated			>		77/
170- 280	Mudstone, gray, slightly cal- careous			3 100		
280- 295	Sandstone, fine- to medium- grained, angular, relatively unclean					<u>.</u> <u></u>
295- 300	Mudstone, gray, semi-hard			- {		
300- 320	Mudstone to siltstone, gray and reddish-brown, calcareous			200		
320- 340	Mudstone, dark-gray; possibly a limestone bed between 320 ft and 325 ft					
340- 355	Sandstone, brown, medium-grained, angular, unclean			250	13-1	
355- 370	Mudstone, gray			31.3		

TOP OF PRICE RIVER FORMATION  370- 400 Siltstone to sandstone, gray 400- 465 Sandstone, gray, salt-and-pepper, subangular grains 465- 480 Mudstone, brown and gray 480- 580 Sandstone, gray, salt-and-pepper, subangular grains 580- 655 Sandstone, fine- to medium-grained, alternating clean, with salt-and-pepper appearance 655- 670 Sandstone, gray, fine- to medium-grained, hard; alternating thin beds of mudstone, gray 670- 770 Sandstone, gray, fine, with shaly siltstone stringers 770- 800 Mudstone, gray, hard 800- 825 Sandstone, medium-grained, alternating with mudstone, gray 825- 840 Mudstone, dark-gray 840-1,015 Mudstone, gray, alternating with siltstone, gray 1,015-1,020 Sandstone, gray, fine- to medium-grained 1,020-1,160 Mudstone, gray, with siltstone partings 1,160-1,220 Sandstone, medium- to fine-grained, with mudstone chips 1,220-1,300 Mudstone, dark-gray, hard 1,300-1,340 Mudstone, gray and brownish-red TOP OF CASTLEGATE SANDSTONE	Gam	Den 350	Cal	Res
370- 400 Siltstone to sandstone, gray 400- 465 Sandstone, gray, salt-and-pepper, subangular grains 465- 480 Mudstone, brown and gray 480- 580 Sandstone, gray, salt-and-pepper, subangular grains 580- 655 Sandstone, fine- to medium-grained, alternating clean, with salt-and-pepper appearance 655- 670 Sandstone, gray, fine- to medium-grained, hard; alternating thin beds of mudstone, gray 670- 770 Sandstone, gray, fine, with shaly siltstone stringers 770- 800 Mudstone, gray, hard 800- 825 Sandstone, medium-grained, alternating with mudstone, gray 825- 840 Mudstone, dark-gray 840-1,015 Mudstone, gray, alternating with siltstone, gray 1,015-1,020 Sandstone, gray, fine- to medium-grained 1,020-1,160 Mudstone, gray, with siltstone partings 1,160-1,220 Sandstone, medium- to fine-grained, with mudstone chips 1,220-1,300 Mudstone, dark-gray, hard 1,300-1,340 Mudstone, gray, softer than above 1,340-1,405 Mudstone, gray and brownish-red		350		
400- 465 Sandstone, gray, salt-and-pepper, subangular grains 465- 480 Mudstone, brown and gray 480- 580 Sandstone, gray, salt-and-pepper, subangular grains 580- 655 Sandstone, fine- to medium-grained, alternating clean, with salt-and-pepper appearance 655- 670 Sandstone, gray, fine- to medium-grained, hard; alternating thin beds of mudstone, gray 670- 770 Sandstone, gray, fine, with shaly siltstone stringers 770- 800 Mudstone, gray, hard 800- 825 Sandstone, medium-grained, alternating with mudstone, gray 825- 840 Mudstone, dark-gray 840-1,015 Mudstone, gray, alternating with siltstone, gray 1,015-1,020 Sandstone, gray, fine- to medium-grained 1,020-1,160 Mudstone, gray, with siltstone partings 1,160-1,220 Sandstone, medium- to fine-grained, with mudstone chips 1,220-1,300 Mudstone, dark-gray, hard 1,300-1,340 Mudstone, gray, softer than above 1,340-1,405 Mudstone, gray and brownish-red		350		
subangular grains  465- 480 Mudstone, brown and gray  480- 580 Sandstone, gray, salt-and-pepper, subangular grains  580- 655 Sandstone, fine- to medium-grained, alternating clean, with salt-and-pepper appearance  655- 670 Sandstone, gray, fine- to medium-grained, hard; alternating thin beds of mudstone, gray  670- 770 Sandstone, gray, fine, with shaly siltstone stringers  770- 800 Mudstone, gray, hard  800- 825 Sandstone, medium-grained, alternating with mudstone, gray  825- 840 Mudstone, dark-gray  840-1,015 Mudstone, gray, alternating with siltstone, gray  1,015-1,020 Sandstone, gray, fine- to medium-grained  1,020-1,160 Mudstone, gray, with siltstone partings  2,160-1,220 Sandstone, medium- to fine-grained, with mudstone chips  1,220-1,300 Mudstone, dark-gray, hard  1,300-1,340 Mudstone, gray, softer than above  1,340-1,405 Mudstone, gray and brownish-red		350		
Sandstone, gray, salt-and-pepper, subangular grains  580- 655 Sandstone, fine- to medium- grained, alternating clean, with salt-and-pepper appearance  655- 670 Sandstone, gray, fine- to medium- grained, hard; alternating thin beds of mudstone, gray  670- 770 Sandstone, gray, fine, with shaly siltstone stringers  770- 800 Mudstone, gray, hard  800- 825 Sandstone, medium-grained, alternating with mudstone, gray  825- 840 Mudstone, dark-gray  840-1,015 Mudstone, gray, alternating with siltstone, gray  1,015-1,020 Sandstone, gray, fine- to medium- grained  1,020-1,160 Mudstone, gray, with siltstone partings  2,160-1,220 Sandstone, medium- to fine- grained, with mudstone chips  1,220-1,300 Mudstone, dark-gray, hard  1,300-1,340 Mudstone, gray, softer than above  1,340-1,405 Mudstone, gray and brownish-red		100		
subangular grains  580- 655 Sandstone, fine- to medium- grained, alternating clean, with salt-and-pepper appearance  655- 670 Sandstone, gray, fine- to medium- grained, hard; alternating thin beds of mudstone, gray  670- 770 Sandstone, gray, fine, with shaly siltstone stringers  770- 800 Mudstone, gray, hard  800- 825 Sandstone, medium-grained, alternating with mudstone, gray  825- 840 Mudstone, dark-gray  840-1,015 Mudstone, gray, alternating with siltstone, gray  ,015-1,020 Sandstone, gray, fine- to medium- grained  ,020-1,160 Mudstone, gray, with siltstone partings  ,160-1,220 Sandstone, medium- to fine- grained, with mudstone chips  ,220-1,300 Mudstone, dark-gray, hard  ,300-1,340 Mudstone, gray, softer than above  ,340-1,405 Mudstone, gray and brownish-red		400		
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,340-1,405 Mudstone, gray and brownish-red		\$		H
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4. I	T. Hill	630		
,405-1,425 Sandstone, fine- to medium- grained, fairly clean	-			をするが上
,425-1,430 Sandstone, gray, fine-grained TOP OF BLACKHAWK FORMATION		3		1444
,430-1,480 Sandstone, medium-grained, fairly well sorted, angular		\$ 700		1
,480-1,515 Mudstone to siltstone, very carbonaceous	1	2		

Hole No. BC-3-RC (continued)

LITHOLOGY		STRIP		GEOPHYS	ICAL LO	GS
	HIMOLOGI	STI	Gam	Den	Cal	Res
1,515-1,520	Siltstone, fine- to medium- grained, 50% quartzitic, 50% carbonaceous		-	Transport 800	<b>* * * * * * * * * *</b>	
1,520-1,540	Sandstone, fine- to medium- grained, very carbonaceous		-	3	ALL A	
1,540-1,560	Sandstone to siltstone, fine- grained, very carbonaceous			850		
1,560-1,600	Sandstone to siltstone, fine- grained, with carbonaceous mudstone and shale; 3-ft coal seam at 1,562 ft		-		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	
1,600-1,620	Sandstone to siltstone, fine- grained, carbonaceous		=	5 900	{	_
1,620-1,660	Siltstone to sandstone, fine- grained, carbonaceous; 1-ft coal seam at 1,650 ft		1	Mary Mary	}	10-2
1,660-1,670	Siltstone to sandstone, fine- grained		-	950	}	<u> </u>
1,670-1,700	Sandstone, fine, calcareous cement		-	3	}	-
	Total depth: 1,700 ft			\$ 1000		4
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Hole No. BC-3-RC (continued)

LITHOLOGY		d b		GEOPHYS	ICAL LOG	S
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		U.S. GEOLOGI DRILL-HOLE LOG, E			JTAH		
Hole No	BC BC	-4-RC Quadrangle Rang	e Creek		Elevation	4,875 ft	
Rotary-		Cored interval 1,122.3'  Cored interval 1,27  Drilling	2.6 L	ogged	2,050' FNL depth 1,270 r, foam, an		lepth <u>1,27</u>
Geophys	sical	logs:					
Re	esisti	(Cal) - Logging speed: 40 ft/r	Sc	ale:	20 ft/min 25Ω/log d	14	-
De	ensity	Gam): T.C. sec.  (Den): T.C. 1 sec.  Gamma not logged			200 cps/lo	g div.	•
I I TENOY OCY					GEOPHYS	SICAL LOG	S
		LITHOLOGY	STRIP	Gam	Den	Cal	Res
0- 80- 100- 120- 150-	100 120 150	Alluvium  Siltstone, gray (Kpm on fig. 3)  Sandstone, light-gray, fine-grained, well-indurated  Siltstone, hard  Sandstone, light-gray to white, fine- to medium-grained,			50		
170-	185	subangular, hard Siltstone, gray					
185-	205	Mudstone, dark-gray			100		
205-	220	Siltstone, gray					
220-	225	Sandstone, light-gray, fine- grained, well-indurated				\[ \]	The state of the s
225-	235	Mudstone, dark-gray			150	3	
235-	245	Sandstone, gray, fine-grained, hard				}	The state of the s
245-	260	Siltstone to mudstone, gray				\$	

10

Sandstone, gray, fine-grained, hard

280 Mudstone to siltstone, gray to dark-gray, very hard

Sandstone, light-gray, fine-

Sandstone, light-gray, fine-

Siltstone, gray, hard

Siltstone, dark-gray

grained, hard

340 Mudstone, dark-gray

grained

260-

270-

280-

300-

325-

340-

345-

270

300

325

345

355

		LITHOLOGY	STRIP	GEOPHYSICAL LOG		GS	
		BIHOLOGI .	STE	Gam	Den	Ca1	Re
355-	360	Siltstone, gray		1			
360-	370	Sandstone, light-gray, fine- grained					
370-	375	Siltstone, dark-gray			350		
375-	385	Sandstone, light-gray, fine- grained, alternating with gray siltstone					
385–	425	Sandstone, light-gray, fine- grained; minor thin layers of gray siltstone			400		
425-	430	Sandstone, gray, clean		1		1	
430-	455	Sandstone, fine- to medium- grained; calcite cement. Soft, white cuttings indicate poss- ible gypsum or kaolinite			<i>450</i>		T T
455-	460	Siltstone, dark-gray; vein of calcite					
460-	485	Siltstone, gray, black at 480 ft					
485-	510	Sandstone, light-gray, fine- to medium-grained, well-indurated			500		
510-	550	Siltstone, dark- to medium-gray		100		}	
550-	580	Sandstone, medium-gray, medium-grained, well-sorted, well-rounded			550		
580-	585	Mudstone, dark-gray					
585-	595	Sandstone, medium-gray, medium-grained					
595-	605	Mudstone, dark-gray			600		
605-	615	Siltstone, light-gray, well- sorted, well-rounded, clean		·			
615-	625	Mudstone, dark-gray					
625-	635	Siltstone, medium-gray		3	esd		
635-	640	Mudstone, dark-gray		Ē		[[/	
640-	645	Siltstone, medium-gray				1	
645-	660	Mudstone, dark-gray					
660-	670				700		
670-	685	Mudstone, dark-gray					
685-	690	Mudstone, dark-gray; siltstone, light-gray					
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GEOPHYSICAL LOGS

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as 1 in. thick; some pyrite (Kc on fig. 3)

7	LITHOLOGY	STRIP 10G	•	GEOPHYS	SICAL LO	GS
		STR	Gam	Den	Cal	Res
1,034 -1,035	Silty shale, dark-gray		<b>E</b>			
1,035 -1,075	Sandstone, light- to medium- gray, fine-grained			1, 1200		
	TOP OF BLACKHAWK FORMATION					
1,075 -1,084	Silty shale, dark-gray, inter- bedded with light-gray sandstone. About 6 ft of shale and 4 ft of sandstone			12.50		
1,084 -1,096	Sandstone, light-gray, medium- to fine-grained, mostly clean; some coaly material in thin stringers					
1,096 -1,126	Siltstone, light-gray; abundant coaly stringers; some thin shale layers; pyrite				•	
1,126 -1,133.6	Sandstone, light-gray, fine- grained; very few stringers of carbonaceous material			À		
1,133.6-1,134.5	Shale, dark-gray					
1,134.5-1,151.3	Sandstone, light-gray, very fine grained; siltstone; abundant coal stringers			*		
1,151.3-1,151.9	Coal and carbonaceous shale				•	
1,151.9-1,153.7	Shale, carbonaceous					
1,153.7-1,153.9	Coal					
1,153.9-1,155.6	Shale, carbonaceous; some coal stringers					
1,155.6-1,158.5	Siltstone, medium-gray; abundant carbonaceous material		٠			
1,158.5-1,166.4	Shale, carbonaceous; minor interbeds of siltstone					
1,166.4-1,168.2	Coal and carbonaceous shale					
1,168.2-1,171	Siltstone and silty shale					
1,171 -1,192	Sandstone, light-gray, fine- grained, well-sorted, well- rounded; >10% dark minerals in a matrix of quartz grains; grades downward to siltstone					

Gam

GEOPHYSICAL LOGS

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Res

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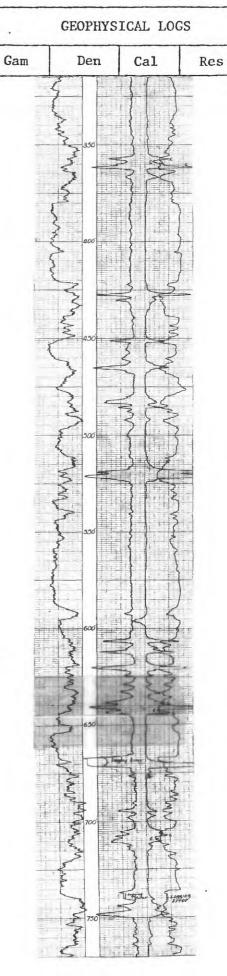
	LITHOLOGY	STRIP
1,192 -1,216.5	Siltstone, light-gray, some stringers of carbonaceous material	
1,216.5-1,218	Siltstone interbedded with shale	
1,218 -1,237.5	Sandstone, light-gray, fine- grained, well-rounded, with some carbonaceous stringers; crossbedded	
1,237.5-1,241	Siltstone, light-gray, well- rounded, with some carbona- ceous material	
1,241 -1,272.6	Siltstone with interbedded shale and carbonaceous material. 80% siltstone	
	Total depth: 1,272.6	

### U.S. GEOLOGICAL SURVEY DRILL-HOLE LOG, EMERY COUNTY, UTAH

Hole No	o. BC	C-6-RC Quadrangle Range	Creek		Elevation	5,840	Ēt
Locatio	on: '	T. 17 S., R. 15 E., sec. 23	300'	FSL	2,000' FEL		1
Rotary-	_	Cored interval	L	ogged			depth <u>1,59</u>
Geophys	sical	logs:					
		r (Cal) - Logging speed: 40 ft/min ivity (Res):		hers:	1- 1-		
		(Gam): T.C. 2 sec.			15 cps/lo	g div.	
		y (Den): T.C. 1 sec.			200 cps/lo		<del></del>
Remarks							_
						OTO17 70	200
		LITHOLOGY	STRIP		GEOPHY	SICAL LO	t
	w. a. w		ST	Gam	Den	Cal .	Res
0-	10	Alluvium					1
10-	60	Shale, maroon, variegated; lime- stone bed at 15 ft, gray; thin limestone beds throughout					
60-	80	Shale, reddish-brown			50		₹ n - 1 1 
80-	100	Mudstone, gray, soft			\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \		
100-	120	Limestone					
120-	125	Shale, reddish-brown			3		
125-	135	Shale, gray			100		
135-	160	Silty limestone, gray					
160-	170	Shale, gray			1	1 1	
170-	180	Shale, reddish-brown			}-	3 33	TIO I
180-	210	Limestone, white; interbedded with gray shale and mudstone			150	3	-
210-	250	Mudstone, gray			5	3 7	
250-	280	Mudstone, dark-gray			3	3) }	
280-	300	Siltstone, gray				1	
300-	305	Sandstone, fine-grained			200	1 ( 5	
305-	320	Sandstone, fine-grained; mudstone, dark-gray					· ·
320-	325	Sandstone, fine- to medium-grained			}	} .	
325-	330	Sandstone, fine- to medium-			250	3 . {}	
		grained; mudstone, dark-gray				3.85	+
330-	335	Sandstone, medium-grained			and the	3	
			1 1		>	3 1	112

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		LITHOLOGY	STRIP
335-	340	Mudstone, gray	
340-	360	Shale, brownish-gray	
360-	400	Sandstone, fine- to medium- grained, alternating with shale	
		TOP OF PRICE RIVER FORMATION	
400-	510	Sandstone, gray, salt-and-pepper, medium-grained	
510-	555	Shale, black; siltstone	
555-	585	Sandstone, fine-grained	
585-	590	Shale, dark-gray	
590-	600	Sandstone, very fine grained	
600-	640	Shale, black	
640-	650	Siltstone, fine-grained	
650-	660	Shale, black	
660-	670	Sandstone, medium-grained, angular	
670-	730	Shale, black	
730-	745	Sandstone, black, fine-grained; pink chert	
745-	760	Shale, black	
760-	775	Shale, black; sandstone	
775-	785	Shale, black	
785-	795	Shale, black, carbonaceous	
795-	900	Shale and mudstone, black	
900-	910	Sandstone, medium-grained, clean	
910-1	,055	Shale and sandstone, black	
1,055-1	,060	Siltstone, gray	
1,060-1	,065	Mudstone	
1,065-1	,100	Siltstone, dark-gray, alternating with light-gray mudstone	
1,100-1	,105	Mudstone, dark-gray	
1,105-1	,155	Mudstone, light-gray	
1,155-1	,160	Mudstone, gray	
1,160-1	,165	Siltstone, dark-gray	
1,165-1	,180	Siltstone and mudstone, alternating	



	LITHOLOGY	STRIP		GEOPHYS	SICAL LOC	GS
	BIMOROOI	STI	Gam	Den	Cal	Res
1,180-1,200	Siltstone; Sandstone, gray, medium-grained			3		in.
1,200-1,235	Mudstone and siltstone			5 800		L
	TOP OF CASTLEGATE SANDSTONE		1	\$	50	± + + + + + + + + + + + + + + + + + + +
1,235-1,340	Sandstone, medium-grained			-		
	TOP OF BLACKHAWK FORMATION		-	2		
1,340-1,345	Mudstone, gray			\$ 850	1) { 5	
,345-1,360	Sandstone, fine- to medium-grained			7		
1,360-1,380	Siltstone and mudstone, dark-gray, alternating			{	1	
1,380-1,400	Mudstone, gray		==	\$ 900		<u>-</u>
1,400-1,530	Mudstone, gray, interbedded with dark-gray to black siltstone and shale. Some carbonaceous shale stringers			Many Many Many Many Many Many Many Many	7	# 
1,530-1,590	Siltstone and fine sandstone		1	5950	300	1
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	17			\$ 1200		3

Hole No. BC-6-RC (continued)

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### U.S. GEOLOGICAL SURVEY DRILL-HOLE LOG, EMERY COUNTY, UTAH

Hole No	). <u>B</u>	C-7-RC Quadrangle Range C	reek	E	levation	5,200	ft
Locatio	on: T	c. <u>17</u> S., R. <u>16</u> E., sec. <u>30</u>	300	FSL 1,	200' FEL		1
Rotary-		cpth 931' Cored interval 931-1,0 Drilling m	83' L	ogged de	pth 1.,081		depth 1,08
Geophys	sical	logs:					
Re Ga	esisti amma ( ensity		Sc.	ale: 12	ft/mi 2.5 Ω/log 0 cps/log 0 cps/log	g div.	
			A C		GEOPHY	SICAL LO	GS
		LITHOLOGY	STRIP	Gam	Den	Cal -	Res
0-	30	Silty shale, dark-gray			σ		
30-	50	Sandstone, light-gray, very fine grained, poorly sorted, sub-angular, soft; abundant dark minerals					
50-	55	Shale, medium-gray, fissile	i i		50	١	
55-	60	Siltstone, light-gray, to sand- stone, very fine grained, poorly sorted, subangular, soft; abundant dark minerals				<b>)</b>	
		TOP OF PRICE RIVER FORMATION			100		
60-	65	Shale, dark-gray, carbonaceous					
65-	70	Shale, medium-gray		32			
70-	95	Siltstone, light-gray					
95-	105	Shale, dark-gray			150		
105-	110	Sandstone, light-gray, very fine grained; shale, dark-gray					
110-	125	Shale, dark-gray					
125~	150	Sandstone, light-gray, very fine grained, poorly sorted, sub-angular, poorly cemented; abundant dark minerals			200		
150-	185	Silty shale, dark-gray; coal, ferrous, at 170-175 ft					to A. M.  The Control of the Control
185-	190	Shale, dark-gray, carbonaceous; siltstone, light-gray					And the second s
190-	195	Shale, black, carbonaceous; coal					-

		LITHOLOGY	SILP		GEOPHYS	SICAL LO	GS
		LIMOLOGI	STRIP	Gam	Den	Cal	Res
195-	200	Sandstone, salt-and-pepper appearance, very fine grained; minor black carbonaceous shale		C	3>		
200-	205	Shale, medium-gray			350		
205–	230	Sandstone, light-gray, fine- grained, poorly sorted, sub- angular, poorly cemented			<b>&gt;</b>		
230-	235	Sandstone, as above, with some dark-gray, silty shale			200		
235-	250	Silty shale, dark-gray; abundant pyrite		Į.			
250-	270	Siltstone, light-gray					
270-	285	Silty shale, dark-gray; coal- bearing at 280-285 ft			450		
285-	315	Sandstone, light-gray, fine- grained, clean					
315-	340	Siltstone, medium-gray, very hard, pyritic					
340-	360	Silty shale, dark-gray			500		
360-	405	Sandstone, light-gray, very fine to silt-sized grains; some dark shale from 375 ft to 405 ft					
405-	420	Silty shale, dark-gray			550		7
420-	430	Sandstone, light-gray, very fine grained					1
430-	445	Siltstone, dark-gray					And Andrews
445-	455	Siltstone, light-gray					
455–	500	Siltstone, light-gray, with interbedded coal-bearing carbonaceous shale			600		Factors of the control of the contro
500-	510	Siltstone, dark-gray, to silty shale		*			
510-	515	Sandstone, light-gray, very fine grained			650		
515-	565	Silty shale, dark-gray					
565–	605	Siltstone, light-gray, to very fine grained sandstone, inter- bedded with coal-bearing carbonaceous shale			700		
605–	630	Silty shale, dark-gray		<b>-</b>			

STRIP

			Hole No. BC-/-RC
			LITHOLOGY
630	-	645	Sandstone, light-gray, very fine grained
645	-	720	Sandstone, as above, with some pyrite and interbedded with coal-bearing carbonaceous shale
720	_	740	Silty shale, dark-gray
740	-	750	Sandstone and shale, inter- bedded as above
			TOP OF CASTLEGATE SANDSTONE
750	-	885	Sandstone, light-gray, fine- grained, well-rounded
			TOP OF BLACKHAWK FORMATION
885	-	890	Shale, dark-gray, with inter- bedded siltstone
890	-	915	Sandstone, light-gray, fine- grained, with carbonaceous material
915	-	932.7	Sandstone, light-gray, very fine to silt-sized grains
932.7		932.8	Silty shale to siltstone, dark-gray
932.8	-	939.6	Siltstone, light-gray, with interbedded carbonaceous shale and coal as much as 0.2 ft in thickness
939.6	-	941.2	Shale, carbonaceous; coal at 940.1-940.5 ft
941.2-	-	942.9	Shale, carbonaceous; coal
942.9-		944.7	Siltstone and carbonaceous shale
944.7-	-	945.6	Coal and carbonaceous shale
945.6-	-	951.5	Siltstone, light-gray
951.5-	-	951.7	Coal
951.7-	-	955.1	Siltstone
955.1-	-	955.8	Coal
955.8-		956.5	Siltstone, light-gray
956.5-		957.5	Silty shale and coal-bearing carbonaceous shale
957.5-		958.7	Shale, carbonaceous, inter- bedded with coal

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GEOPHYSICAL LOGS

Hole No. <u>BC-7-RC</u> (continued)

		LITHOLOGY	STRIP		GEOPHYS	ICAL LO	SS
			STI	Gam	Den	Ca1	Res
958.7-	962.8	Silty shale, dark-gray					
962.8-	964.1	Siltstone, light-gray					
964.1- 973 -	973 994.8	Sandstone, medium-gray, fine- grained; abundant dark minerals; deformation struc- tures present Sandstone, light-gray, massive, with some crossbedding			- (-)-(-)-(-)-(-)-(-)-(-)-(-)-(-)-(-)-(-	e.	
994.8-	998.6	Shale, dark-gray; some carbona- ceous material, interbedded with siltstone		i			
998.6-1	,083	Sandstone, light-gray, fine- grained; interbedded shales as much as 0.3 ft thick at top, 0.5 ft thick in the middle, and 0.1 ft thick at the bottom; some carbona- ceous material					
	5.	Total depth: 1,083 ft					

### U.S. GEOLOGICAL SURVEY DRILL-HOLE LOG, EMERY COUNTY, UTAH

Hole No.	BC-8-RC Quadrangle Range	Creek	1	Elevation	4,950 f	t
Location	n: T. 17 S., R. 16 E., sec. 33	, 700	' FWL 2	00' FNL		1
Rotary- drille	ed depth 1,020' Cored interval 0 Drilling				' Total	depth <u>1,02</u>
Geophysi	ical logs:					
Cal	Liper (Cal) - Logging speed: 40 ft/min	. Ot	hers:	20. ft/mir	ı	
Res	sistivity (Res):		ale:			_
Gan	nma (Gam): T.C. $\frac{2}{}$ sec.		_	5 cps/log		<del>-</del> /-
Den Remarks:	Resistivity scale not shown on log	Sc	ale: 14	0 cps/1og	div.	
		Pl ch		GEOPHYS	SICAL LO	GS
	LITHOLOGY	STRIP	Gam	Den	Cal	Res
0- 15	Alluvium		Na	tural Gamma O Focu	ised Califor	A
15- 16	Shale, dark, carbonaceous; coal streaks			The same of the sa		
16- 20	Shale, gray to brown			53	>	
20- 30	Sandstone, dark-gray, fine-grained, slightly carbonaceous			50		
30- 40	Sandstone, medium-grained, clean		F	-		1 3
40- 50	Sandstone, fine- to medium-grained,			3		
	poorly sorted		12	55		
50- 65	Siltstone to mudstone, gray, soft; some sandstone beds, fine-grained		E	100		
65- 70	Mudstone		_	3	1	W To a
70- 80	Siltstone to sandstone, gray, fine-grained		(			
80- 85	Sandstone, gray, fine-grained		3	150		
85-130	Sandstone, medium-grained		}			44 177
130-135	Sandstone, medium-grained; thin siltstone bed		3			
135-180	Sandstone, medium-grained, clean, well-rounded		{	-200		1
180-185	Micaceous siltstone to mudstone, dark-gray to black, very thinly bedded		5	Jan		# 34 - 14 - 14
185–195	Siltstone, gray		-	250 12	Flore of decisions	

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	LITHOLOGY	STRIP	,	GEOPHYS	ICAL LO	GS
	HIMOLOGI .	STS	Gam	Den	Ca1	Res
95-200	Sandstone, fine- to medium-grained		,	white the		RENT
200–215	Sandstone, medium-grained, well- sorted, very clean, well-rounded		(	275	\$   7   5	
215-220	Sandstone, gray, fine-grained, very hard		\$	300		
220-230	Mudstone to siltstone, gray		(		}	>.
230–250	Sandstone, medium-grained, with silt- stone stringers		1		}	
250-255	Siltstone, dark-gray		-	350 5	1 5	>
255-260	Sandstone, dark-gray, fine-grained			3 <	3 5	
60-300	Sandstone, medium-grained, very clean, well-rounded		**face		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	}
300-315	Mudstone to siltstone, carbonaceous		-	400	1-1-3	
315-345	Sandstone, white, medium-grained, clean			\$		
345-375	Siltstone, gray to dark-gray, carbona- ceous		· ·	3	}	
75-385	Sandstone, white, medium-grained		-	450		
85-440	Sandstone, medium-grained, alternating with carbonaceous siltstone to mudstone		-	\$ 475 <b>\$</b>		<b>&gt;</b>
	TOP OF CASTLEGATE SANDSTONE			500	}	
40–680	Siltstone to mudstone, black, carbona- ceous; some carbonaceous sandstone			3		
80-800	Castlegate Sandstone, medium-grained; thin coal seam less than 1 ft at 682 ft		£.	35	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	
00–875	TOP OF BLACKHAWK FORMATION Sandstone, medium-grained, alternating with carbonaceous siltstone to mudstone		»	575		
375–878 378–885 85–890	Coal; carbonaceous shale Siltstone, gray, carbonaceous Shale, carbonaceous; 2-ft coal bed at 885 ft		11	\$ 600		7
90-895	Coal; carbonaceous shale		=	<b>\[ \]</b>	\$ 5	
95–900	Good coal; some carbonaceous shale.  Beckwith coal zone, 875-900 ft				15	
900–980	Sandstone, medium- to fine-grained, with carbonaceous streaks			656	11 8	>
980-985	Shale, carbonaceous; possibly a coal split. Sunnyside coal zone		_	3 -15	3 =	5

Hole No. BC-8-RC (continued)

LITHOLOGY	STRIP		GEOPHYSICAL LOG		
	01	Gam	Den	Cal	Res
-1,020 Sandstone, fine-grained, carbonaceon	18	-		}   \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	- 1
Total depth: 1,020		- A	195	{   }	
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#### U.S. GEOLOGICAL SURVEY DRILL-HOLE LOG, EMERY COUNTY, UTAH

Quadrangle Range Creek Elevation 4,760 ft Hole No. BC-9-RC Location: T. 17 S., R. 16 E., sec. 27 , 950' FWL 1,950' FNL Cored interval \_\_\_\_\_ Logged depth 1,222 Total depth 1,224 Rotarydrilled depth 1,224 ft Drilling medium Air and foam

#### Geophysical logs:

Caliper (Cal) - Logging speed: 40 ft/min. Others: 20 ft/min

Scale:  $14.3 \Omega/\log \text{div}$ . Resistivity (Res):

T.C.  $\frac{2}{3}$  sec. Scale: 15 cps/log div. Gamma (Gam):

LITHOLOGY		I I TRUCT COV	d D		GEOPHYSICAL LOGS			
		LIINOLOGI	STRIP	Gam	Den	Cal	Res	
0-	55	Alluvium			, 0	K		
55-	85	Sandstone, light-gray, fine- grained; interbedded gray mudstone						
85-	115	Mudstone, dark-gray			Fluid level	-	1	
115-	135	Mudstone, medium- to dark-gray, with some interbedded sand-stone				Ca. in		
135-	140	Sandstone, light-gray, medium-grained			3 100			
140-	160	Sandstone, medium-gray, medium- to fine-grained; rare mudstone partings					_	
160-	220	Mudstone, dark-gray			2	1/ 2		
220-	225	Sandstone, light-gray, medium- grained			100			
225-	245	Sandstone, light-gray, medium- grained, with some mudstone partings			5	3		
245-	260	Sandstone, gray, medium- to coarse-grained			3 200			
260-	270	Mudstone, dark-gray			}			
270-	290	Sandstone, light-gray, well- sorted, medium- to fine- grained			250			
290-	295	Sandstone, medium-grained			3	1 2	3.11	
295-	305	Mudstone, dark-gray, carbona-			3			

			I TTHOLOGY	H S		GEOPHYS	ICAL LOC	SS
			LITHOLOGY	GY Gam				Res
	305-	320	Sandstone, gray, medium-grained		(			1
	320-	330	Mudstone, gray			3	1 5	
	330-	340	Sandstone, medium-grained			3	}	
	340-	345	Mudstone, carbonaceous			350		-3 ->
	345-	380	Sandstone, light-gray, medium- grained		{			
	380-	400	Mudstone, dark-gray; rare sand- stone streaks		<			ζ,
	400-	410	Sandstone, gray, medium-grained		. 8	400		ę*
	410-	420	Mudstone, carbonaceous		1		} - <	=
	420-	435	Sandstone, gray, medium-grained; specks of coal		1	-	+ 5	-} √
	435-	450	Mudstone, dark-gray			3 450	+ {	
	450-	510	Sandstone, dark-gray, with interbedded carbonaceous shale			3		· ·
	510-	760	Mudstone, dark-gray, carbonaceous			-	1 3	>
			TOP OF CASTLEGATE SANDSTONE		-	500	1 5	
	760-	890	Sandstone, light-gray, medium- grained, well-rounded			3		
			TOP OF BLACKHAWK FORMATION			2		
	890-	983	Mudstone, gray, carbonaceous		1	3		
	983-	985	Coal - Beckwith coal zone		1	350	3	5
	985-	990	Mudstone, dark-gray, carbonaceous		49	5.		
	990-1	,010	Sandstone, light-gray, fine- to medium-grained			3	3	
1	,010-1	,095	Sandstone, light-gray, fine-grained to silt size. Carbonaceous material from 1,040 to 1,095 with stringers of coal at 1,085-1,087. Sunnyside coal zone			600		
1	,095-1	,224	Sandstone, light-gray, very fine grained; calcareous cement					
			Total Depth: 1,224 ft			5	2	
						3		r
						700		
				1		18 -	1 2	

Hole No. BC-9-RC (continued)

LITHOLOGY		STRIP	GEOPHYSICAL LOGS			
LIIMOLOGI		STI	Gam	Den	Cal	Res
				5 730		7
			5	3		
	124					
			}	800	1	
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<b>*</b>			_	3		
				1100		
			-4	3		
			1	1		
				1130	1 - 5	

Hole No. BC-9-RC (continued)

GEOPHYSICAL LOGS STRIP LOG LITHOLOGY Gam Den Ca1 Res

### U.S. GEOLOGICAL SURVEY DRILL-HOLE LOG, EMERY COUNTY, UTAH

Hole No. BC-2-W	QuadrangleWood	lside	E	levation	6,150	ft			
Location: T. 17 S.,	R. 15 E., sec. 18	3 , 1,500	FNL 2,	100'FEL		١			
Rotary- drilled depth 740'	Cored interval	Lo	ogged de	pth <u>-738'</u>		depth <u>740'</u>			
drifted depth 740	Drilli	ng medium	Air,	foam, and	water				
Geophysical logs:	4								
Caliper (Cal) - Log	ging speed: 40 ft/	min. Otl	hers:	20 ft/min	n				
Resistivity (Res):		Sca	ale:	$10\Omega/\log$ div.					
Gamma (Gam):	T.C. $\frac{1}{}$ sec.			20 cps/log div.					
Density (Den):		Sca	ale: 20	00 cps/lo	g div.	-			
Remarks: No lithologic	log on this hole								
Y TOWNS	0.00	H to		GEOPHYSICAL LOGS					
LITHOL	UGY	STRIP	Gam	Den	Cal	Res			
				0 =					
			- k	{					
			7:	}	}				
\$			K	50	3				
					1				
			- }						
					3				
			<b>\</b>	100					
(1)			3		\$ 1				
					3 1	<del>- 1</del>			
				150	3				
			+		3 1				
			1	<b>*</b>	3				
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						- 1			
				250	F5 :s	- ALM			
						5			
				3	111)				
	30			}					

. Hole No. BC-2-W (continued)

STRIP GEOPHYSICAL LOGS LITHOLOGY Gam Den Cal Res 702-718 Coal 31

#### U.S. GEOLOGICAL SURVEY DRILL-HOLE LOG, EMERY COUNTY, UTAH

Hole No.	BC-3-W Quadrangle Woodside		1	Elevation	6,400 f	t				
Rotary- drilled depth 955.7'  Cored interval 1,212 ft Logged depth 1,212 Total depth 1,2  Drilling medium Air, foam, and mud										
Geophysi	cal logs:									
Res	iper (Ca1) - Logging speed: 40 ft/min. istivity (Res): ma (Gam): T.C sec. sity (Den): T.C sec. Time constant not indicated. Sub	Sc. Sc.	ale: ale: ale: _2	16.7 Ω/1 15 cps/lo 00 cps/lo	og div. g div. g div.	og depths.				
		8.0		GEOPHY	SICAL LO	GS				
	LITHOLOGY	STRIP	Gam	Den	Cal ·	Res				
19- 27 27- 38 38- 53 53- 58 58- 60	Start drilling in Flagstaff Limestone and North Horn Formation, undifferentiated  Shale, brown  Shale, gray  Sandstone, gray, medium-grained, clean Shale, light-gray  Shale, dark-gray  Silty limestone, gray  Shale, gray  Siltstone to fine sandstone, gray  Shale, gray and black; thin streaks of coaly and carbonaceous material  Silty shale, dark-gray  Shale, brown, with coal stringers  Shale, gray  Sandstone, medium-grained TOP OF PRICE RIVER FORMATION Sandstone, gray, fine-grained, well-sorted  Sandstone, medium-grained, well-sorted, very angular  Sandstone, gray, fine-grained, well-sorted			50 So						

	LITHOLOGY	SCIP		GEOPHYS	ICAL LO	GS
	LIMOLOGI	STRIP	Gam	Den	Ca1	Re
150-155	Sandstone, dark-gray, medium-grained				13.1-1	
L55 <b>–</b> 165	Sandstone, light-gray, fine- to medium-grained					
L65 <b>–</b> 170	Sandstone, dark-gray, fine-grained		3	350		
70–205	Sandstone, fine-grained, well-sorted; finely disseminated coal at 190 ft			5		
205-230	Sandstone, light-gray, medium-grained			18		
230–250	Sandstone, dark-gray, fine-grained; finely disseminated coal at 240 ft		1	\$400		
250–260	Sandstone, light-gray, fine- to medium-grained		1	1		
260-275	Sandstone, light-gray, medium-grained		İ	18		
275-300	Sandstone, dark-gray, fine-grained		1	450		
300-310	Shale, Gray		1			
310-320	No samples		4	3		
20-325	Shale, gray					
25-360	Sandstone, medium-grained			5 500	3	
360-380	Sandstone, medium- to coarse-grained, fairly clean; carbonaceous material from about 370 to 380 ft		<u>-</u>			
880–410	Sandstone, medium-grained, with interbedded carbonaceous siltstone			5550		
10-445	Sandstone, white, medium-grained, well-sorted, very clean			3		
45–465	Sandstone, brown, medium-grained, with carbonaceous shale			) Windy		
465–480	Sandstone, fine-grained to silty, carbonaceous; interbedded with dark-gray mudstone to shale			500		
80-500	Sandstone, medium-grained, with carbonaceous shale partings					
500-505	Shale, red to gray, with gray silt- stone			5650		
505-510	Shale, carbonaceous, with some thin coal stringers			\$		
10-520	Siltstone, dark-gray			700	3	
520-530	Sandstone, medium-grained, well-rounded			13		
30–540	Sandstone, medium-grained, with carbonaceous siltstone		1			
	33			750		

			LITHOLOGY	STRIP		GEOPHYS	ICAL LO	GS
			2111011001	STI	Gam	Den	Cal	Re
540	-	565	Sandstone, brown, medium- grained, with siltstone to shale stringers					
565	-	585	Sandstone, brown, medium- grained			800		
585	_	600	Shale to siltstone, dark-gray					
600	-	695	Siltstone, light-gray		{			
695	_	700	Shale to carbonaceous silt- stone to coal stringers		4	850		
700	-	730	Siltstone, light-gray		ک			
730	-	740	Siltstone to shale, carbona- ceous		}			
740	-	790	Sandstone, gray, medium- grained		-	900'		
790	-	800	Sandstone, medium-grained, with carbonaceous shale and small amount of coal		7 %	}		
800	-	805	Sandstone, brown, medium- grained		- 1	950		* 1
805	_	810	Mudstone, carbonaceous		\$		2	
810	-	835	Sandstone, gray, medium- to coarse-grained		A mind			
835	-	850	Sandstone, medium— to coarse— grained, with carbonaceous shale and coal stringers			1000	5	
			TOP OF CASTLEGATE SANDSTONE		-	7		
850	-	950	Sandstone, gray, medium- to coarse-grained, clean			050		
950	-	955.7	No samples			<b>3</b>		
		,024.2	Sandstone, medium-grained; 1.5-in. coal split at 959.7 ft; some coal and carbonate stringers throughout the Kc (fig. 3) TOP OF BLACKHAWK FORMATION Mudstone, carbonaceous			3,1100		
1,024.3-1,024.9			Sandstone, medium-grained,	······································		3		
1,027.3-1,024.9		.,	with carbonaceous stringers			a Just		
1,024.	9–1	,026.3	Mudstone, carbonaceous, to carbonaceous siltstone					7/44 144 144
1,026.	3-1	,029.0	Sandstone, medium-grained, clean					

Gam

GEOPHYSICAL LOGS

Den

Ca1

Res

	LITHOLOGY	STRIP
1,029.0-1,031.3	Sandstone, medium-grained, with coal and carbonaceous stringers	
1,031.3-1,031.8	Mudstone, carbonaceous, with coaly material at 1,031.3-1,031.6 ft	
1,031.8-1,032.2	Mudstone, carbonaceous	
1,032.2-1,036.5	Sandstone, fine-grained, with carbonaceous stringers and some thin coal stringers 1/8 in. in thickness	
1,036.5-1,041.8	Sandstone, medium-grained, fairly clean	
1,041.8-1,042.9	Sandstone, medium-grained, with carbonaceous stringers	
1,042.9-1,043.4	Mudstone, carbonaceous, with coal stringers and resin nodules	
1,043.4-1,044.3	Siltstone, carbonaceous	
1,044.3-1,047.3	Sandstone, medium-grained; two carbonaceous stringers at 1,047 ft	
1,047.3-1,047.7	Siltstone, carbonaceous	
1,047.7-1,051.8	Sandstone, medium-grained, clean	
1,051.8-1,061.8	Sandstone, medium-grained, clean, with carbonaceous stringers in lower 2 in.	
1,061.8-1,070.9	Sandstone, medium-grained, with carbonaceous stringers throughout	
1,070.9-1,071.9	Siltstone, dark-gray, with carbonaceous stringers at 1,071.9 ft	
1,071.9-1,072.9	Coal and carbonaceous shale	
1,072.9-1,073	Mudstone, carbonaceous	
1,073 -1,074.7	Coal and carbonaceous shale	
1,074.7-1,076.2	Shale, carbonaceous, with coal stringers	

Res

	LITHOLOGY	SIP		GEOPHYS	ICAL LO	GS
	LIINOLOGI	STRIP	Gam	Den	Ca1	T
1,076.2-1,077.5	Mudstone, carbonaceous, with 2-in. coal stringers at 1,077.5 ft					
1,077.5-1,079.2	Mudstone, carbonaceous, with 50% coal in lower 1 in.				٠.	
1,079.2-1,081.2	Mudstone, carbonaceous, with 0.5-in. coal split at 1,079.2					
1,081.2-1,081.7	Coal					
1,081.7-1,082	Mudstone, carbonaceous, and coal		**			
1,082 -1,082.8	Coal					
1,082.8-1,083	Mudstone, carbonaceous					
1,083 -1,083.1	Coal split					
1,083.1-1,084.6	Sandstone, gray, fine-grained; siltstone					
1,084.6-1,086.2	Coal in upper 6 in.; carbona- ceous shale and mudstone with coal stringers below					
1,086.2-1,087.1	Sandstone, fine-grained; siltstone					
1,087.1-1,089.1	Sandstone, white, medium- grained; carbonaceous stringers					
1,089.1-1,091	Mudstone, dark-gray					
1,091 -1,091.8	Coal and carbonaceous mudstone					
1,091.8-1,093.7	Mudstone, carbonaceous					
1,093.7-1,094.5	Coal with pyrite					
1,094.5-1,101.8	Mudstone, carbonaceous, with coal stringers and pyrite					
1,101.8-1,104.3	Siltstone, grayish-white					
1,104.3-1,104.5	Mudstone, with coal and carbonaceous shale stringers					
1,104.5-1,106.8	Sandstone, light-gray to white, fine-grained					
1,106.8-1,108.2	Sandstone, gray, fine-grained					
1,108.2-1,110	Mudstone to siltstone, carbonaceous, with 1/8-in. coal stringers					

Res

	LITHOLOGY	SCIP		GEOPHYS	ICAL LO	OCS
	BIHOLOGI .	STRIP	Gam	Den	Ca1	
1,110 -1,110.4	Coal and carbonaceous mudstone					
1,110.4-1,112	Mudstone to siltstone, gray					
1,112 -1,114.8	Sandstone, medium-grained, with carbonaceous stringers				**	
1,114.8-1,120.2	Sandstone, medium-grained, very clean					
1,120.2-1,120.8	Sandstone, medium-grained, with carbonaceous stringers					
1,120.8-1,121.3	Coal					
1,121.3-1,121.6	Mudstone, carbonaceous					
1,121.6-1,121.9	Sandstone, medium-grained, with carbonaceous stringer					
1,121.9-1,122	Mudstone, carbonaceous					
1,122 -1,122.8	Mudstone, carbonaceous					
1,122.8-1,127.2	Sandstone, fine-grained, with carbonaceous stringers, becoming carbonaceous mudstone; siltstone, bottom 1 in.					
1,127.2-1,127.6	Coal					
1,127.6-1,132	Sandstone, fine- to medium- grained, with carbonaceous stringers				2	
1,132 -1,132.4	Sandstone, fine-grained, with coal and carbonaceous shale in bottom 1/2 in.					
1,132.4-1,132.8	No samples					
1,132.8-1,142	Siltstone, with carbonaceous stringers		•			
1,142 -1,144.1	Siltstone, with coal stringers					
1,144.1-1,144.6	Sandstone, dark-gray, fine- grained					
1,144.6-1,147.7	Sandstone, fine-grained, to carbonaceous siltstone					
1,147.7-1,148.4	Sandstone, gray, medium- to fine-grained, with coal stringers					
1,148.4-1,152	Sandstone, banded gray and white, fine-grained					10
1,152 -1,152.4	Siltstone, carbonaceous					
	37					

Nole No. BC-3-W (continued)

	LITHOLOGY	STRIP	GEOPHYSICAL LOGS			GS
	HIMOBOOT	STS	Gam	Den	Ca1	Res
1,152.4-1,154.5	Sandstone, fine- to medium- grained; carbonaceous stringers					
1,154.5-1,199.7	Sandstone, medium-grained, very clean				4,	
1,199.7-1,199.9	Shale, carbonaceous; coal			**		
1,199.9-1,201.8	Mudstone, carbonaceous					
1,201.8-1,201.9	Coal					
1,201.9-1,205.9	Coal. Sunnyside coal zone					
1,205.9-1,208.3	Mudstone, carbonaceous; some coal stringers		1			
1,208.3-1,210.2	Mudstone, carbonaceous; interbedded with sandstone, fine-grained					
1,210.2-1,212	Sandstone, fine-grained, with carbonaceous mudstone stringers					
	Total depth:1,212 ft					

Hole No.	BC-5-W Quadrangle Woodside	2		Elevation	6,540	ft	
Location	: T. 17 S., R. 15 E., sec. 21	100'	FNL 2	2,200' FWL		V	
Rotary-	Cored interval	L	ogged		2 Total	depth 1,75	
Geophysi	cal logs:						
	iper (Cal) - Logging speed: 40 ft/min. istivity (Res):		hers: ale:	20. ft/min 16.7 Ω/			
				20 cps/1o		_	
	ma (Gam): T.C. sec.			200 cps/10			
Remarks:	sity (Den): T.C. sec.  Time constant not indicated	50			6	_	
		Pl s		GEOPHYSICAL LOGS			
	LITHOLOGY	STRIP	Gam	Den	Cal -	Res	
	g in Flagstaff Limestone and North rmation, undifferentiated					17	
0- 5	Shale, maroon and light-gray to white			3	3		
5- 10	Limestone			12	3 4		
10- 15	Sandstone, white, fine-grained			301	1	<u>-</u>	
15- 25	Limestone, white			<b>\(\frac{\partial}{2}\)</b>	7		
25- 30	Sandstone, white to light-gray, fine- to medium-grained				3	=	
30- 75	Limy siltstone, gray; gray shale at 45 ft			100			
75- 80	Siltstone to shale, maroon			3			
80- 85	Siltstone, gray			5			
85-180	Limy siltstone to limestone, gray			5	{		
180-185	Limestone, white, chalky			150	3-1		
185-230	Limy siltstone, gray				3	2	
230-250	Sandstone, fine-grained			3 -	3 }		
250-255	Shale to siltstone, gray to dull- brown			200	3		
255-260	Shale, light-maroon			- }	3		
260-265	Siltstone to shale, gray			2	3	-	
265-275	Sandstone, white, fine-grained			=======================================	3		
275-280	Siltstone to shale, dark-gray			250	1		
280-310	Limy siltstone, gray						
310-345	Sandstone, medium-grained, well- rounded; dark minerals at 345 ft.				The state of the s		

		LITHOLOGY	G G		GEOPHYS	ICAL LO	GS
		BIHOLOGI	STRIP	Gam	Den	Cal	Re
345-	365	Siltstone to shale, white to gray				3	
365-	385	Sandstone, medium- to coarse- grained, very well rounded		7		\$	
385-	390	Sandstone, dark-gray			\$ 350		
390-	430	Sandstone, medium- to coarse- grained		{	<b>}</b>		IS#
430-	435	Siltstone, gray		4			
435-	445	Sandstone, fine-grained			}		
445-	455	Sandstone, medium-grained, well-rounded					
455-	470	Shale, brownish-gray		144	₹   F		
470-	485	Sandstone, very fine grained			3	7	
485-	510	Mudstone, light-gray			450	1 1	
510-	540	Siltstone, light-gray	.	100	{		
540-	610	Mudstone, gray					
		TOP OF PRICE RIVER FORMATION		e.	3		
610-	670	Sandstone, fine-grained		-	\$ 500	<b>1</b>	
670-	735	Mudstone, dark-gray		1	\$		
735-	770	Sandstone to siltstone		-	7	1	
770-	790	Shale, gray, silty			3	}	
790-	815	Sandstone, very fine grained		1	5.50		
815-1	,110	Shale, dark-gray, silty; some sandstone, medium-grained			3	7 1	
1,110-1	,170	Sandstone, fine-grained; shale				{	
1,170-1	,180	Shale, dark-gray		i e	2 600	3	
1,180-1	,200	Sandstone, fine-grained			1	3	
L,200-1	,270	Shale, dark-gray		-	3	1	
L,270-1	,315	Sandstone, light-gray, fine- grained			650		
1,315-1	,350	Shale, gray, silty			3		
		TOP OF CASTLEGATE SANDSTONE			3	3 1	
,350-1	,450	Sandstone, light-gray		-	3	1	
1,450-1	,505	Sandstone and shale, dark-gray		- ŭ	700	3 3	
1,505-1	<b>,</b> 650	TOP OF BLACKHAWK FORMATION Shale, dark-gray; mudstone, dark-			13	3	
1,650-1	,750	Shale, gray		=	3	3	
		Total depth: 1,750 ft			£ 750		
		40			2	115	

Hole No. BC-5-W (continued)

STRIP LOG GEOPHYSICAL LOGS LITHOLOGY Den Gam Cal Res 41

Hole No. BC-5-W (continued)

GEOPHYSICAL LOGS STRIP LITHOLOGY Gam Den Ca1 Res 42

Hole No. BC-5-W (continued)

LITHOLOGY		STRIP	GEOPHYSICAL			L LOGS	
BIHOLOGI		STI	Gam	Den	Cal	Res	
	er.			1700			
121							
				0			
	•						

Hole No.	BC-6-W Quadrangle Woodsid	de		Elevation	6,250	ft	-	
	T. 17 S., R. 15 E., sec. 19				2002	``	061	
Rotary- drilled	depth 759.4' Cored interval 759.4- Drilling			depth 901	_ Total	depth -	901	
Geophysica	al logs:							
Calip	per (Cal) - Logging speed: 40 ft/min	. Ot	hers:	20. ft/mir	1			
	stivity (Res):		ale:	2 Ω/log	div.			
Gamma	a (Gam): T.C. 1 sec.	Sc	ale:	20 cps/lo	g div.			
Densi	ity (Den): T.C. $\frac{1}{}$ sec.	Sc	ale:	200 cps/10	g div.			
Remarks:			5-47			-		
	LITHOLOGY	IP G		GEOPHYSICAL LOGS				
	LITHOLOGI	STRIP	Cam	Den	Cal ·	Res	S	
0- 10	Alluvial sand, yellowish-brown			0'				
10- 20	Shale, brown							
7	TOP OF PRICE RIVER FORMATION				$\geqslant \mid \mid \mid$			
20- 35 1	Mudstone, medium-gray				<b>\</b>			
35- 70	Sandstone, yellowish-brown, fine- grained; mostly quartz			50'				
70- 80	Shale, dark-gray, carbonaceous							
80-105	Sandstone, yellowish-brown, as above							
105-110	Mudstone, medium-gray			100				
110-120	Sandstone, yellowish-brown, as above				4			
120-130	Mudstone, medium-gray			\$ 5				
130-140	Shale, silty, light-brown					7 - 1.7		
140-150	Mudstone, dark-gray			150	1)			
150-155	Sandstone, yellowish-brown, fine- grained				7			
155-160	Shale, dark-gray, carbonaceous				3			
160–175	Sandstone, yellowish-brown, fine- grained			200			٠,	
175-205	Mudstone, medium-gray						÷.	
205–225	Sandstone, yellowish-brown, fine- grained							
225-250	Mudstone, medium-gray			250		Le A		
250-255	Sandstone, yellowish-brown, fine- grained				3			
255-260	Shale, chocolate-brown			5				
260-290	Mudstone, dark-gray			- A-A-				

	LITHOLOGY	G H	•	GEOPHYS	SICAL LO	GS
	EIIIIOEOGI	STRIP	Gam	Den	Cal	Re
290 –305	Siltstone, light-gray; mostly quartz		1	1		
305 -330	Mudstone, medium-gray		1	5	1	
330 -340	Siltstone, light-gray		To Ack	350		
340 -345	Shale, light-gray, silty			}		
345 -355	Siltstone, light-gray		1			
355 -380	Mudstone, medium- to dark-gray; some light-gray siltstone			400		
380 -420	Mudstone and shale, dark-gray			3	-	
420 -425	Siltstone, light-gray					
425 -460	Mudstone, dark-gray					
460 -470	Siltstone, light-gray			\$ 450	$\downarrow \downarrow \downarrow \downarrow$	
470 -525	Mudstone, dark-gray		1			
525 -555	Siltstone, medium-gray			ξ		
555 -605	Mudstone, gray			2		
	TOP OF CASTLEGATE SANDSTONE			500	}	
605 -759.4	Sandstone, light-gray, fine- grained; mostly quartz					
	End Rotary; begin core					
759.4-772.5	Sandstone as above, becoming finer downward, to siltstone			550		
	TOP OF BLACKHAWK FORMATION		=	3		
772.5-780.4	Siltstone, light-gray, with interbedded areas of carbona-ceous material			}		
780.5-780.9 780.9-781.4 781.4-781.8	Carbonaceous shale, with minor coal Coal, with carbonaceous shale Carbonaceous shale, with minor coal					
781.8-783.6	Mudstone, with abundant silty, carbonaceous material		•	650		
783.6-788.3	Siltstone; abundant carbonaceous material		5			
788.3-791.3	Coal and carbonaceous shale (about half and half); resin					2
791.3-791.6	Carbonaceous shale, with pyrite		\$	700	}	in a record
791.6-795.1	Silty mudstone					
	45		-			1-3-

	LITHOLOGY	STRIP		GEOPHYS	SICAL LO	GS
		STI	Gam	Den	Cal	Re
795.1-795.8	Carbonaceous shale		1			
795.8-796.1	Silty mudstone					3
796.1-797.4	Siltstone, with carbonaceous material			800		1 Johnson
797.4-798.2	Carbonaceous shale; resin				3	3
798.2-800.1	Siltstone, light-gray			<b>\$</b>		3
800.1-803	Carbonaceous shale and coal			{		3
803 -804.5	Siltstone and carbonaceous material		-4	850		
804.5-804.9	Carbonaceous shale		-			>
804.9-809.4	Siltstone; abundant carbonaceous material					
809.4-810	Carbonaceous shale			900		
810 -811.4	Silty shale; abundant carbonaceous material					3
811.4-812.1	Siltstone; carbonaceous material		1			التم
812.1-812.8	Carbonaceous shale		3			}
812.8-813.4	Coal -			950		
813.4-815	Carbonaceous shale					
815 -817.5	Silty shale					
817.5-818.3	Carbonaceous shale					
818.3-819	Silty mudstone; carbonaceous material					
819 -820.4	Carbonaceous shale					
820.4-822.8	Silty mudstone; carbonaceous material					
822.8-846.3	Silty mudstone, with carbonaceous material and interbedded silt- stone; more siltstone downward, banded white and black					
846.3-846.6	Carbonaceous shale					
846.3-846.8	Coal					
846.8-847.8	Siltstone and carbonaceous material, banded					
847.8-851	Siltstone, light-gray; some carbonaceous material					
851 -852.1	Carbonaceous shale					
852.1-854.4	Mudstone, dark-gray, with carbonaceous material					

LITHOLOGY		STRIP	141	GEOPHYS	ICAL LOC	SS
		STI	Gam	Den	Cal	Res
354.4-864.8	Siltstone and carbonaceous material, banded					
864.8-911.4	Sandstone, fine-grained, friable; crossbedding; some dark layering					
911.4-924.5	Siltstone and carbonaceous material, interbedded, banded					
924.5-927.6	Coal. Sunnyside bed					
927.6-928.2	Carbonaceous shale					
928.2-961.8	Sandstone, grayish, fine-grained, massive at top; crossbedded at bottom; dark bands; some layering		i			
	Total depth: 961.8 ft					
	*					
v •						
	X.					

Hole No.	BC-7-W Quadrangle Woodsi	de	1	Elevation	6,150	Et
Rotary-	Cored interval Drilling	L	ogged de	epth 984'	_ Total	depth 985
Geophysic	cal logs:					
Resi Gamm	iper (Cal) - Logging speed: 40 ft/min istivity (Res):  ma (Gam): T.C. 1 sec.  sity (Den): T.C. 1 sec.  Drilling in Flagstaff Limestone and	Sc Sc Sc	ale: ale: ale:2	20 ft/mi 10 Ω/log 20 cps/le 200 cps/le rmation,	div. og div. og div.	- entiated
	I TENOTOCA	IP G		GEOPHY	SICAL LO	GS
	LITHOLOGY	STRIP	Gam	Den	Cal .	Res
7- 20 20- 25 25- 30 30- 40 40- 47 47- 65 65- 70 70- 75				56 100		
75- 80			6.1 X			
80- 85 85-175	siltstone  TOP OF PRICE RIVER FORMATION  Sandstone, medium-grained, well- sorted, very clean		\$ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\	200		
175-190	Siltstone, gray			250	1	
190–215	Sandstone, medium-grained, well- sorted, clean		±	7		
215-225	Siltstone, gray to dark-gray		=		3	
225–245	Sandstone, gray, medium-grained 48			300		

	LITHOLOGY	STRIP		GEOPHYS	ICAL LO	GS
	HIMOBOOT	STI	Gam	Den	Cal	Res
245-250	Siltstone, gray					
250-255	Siltstone, dark-gray to brown; brown shale				\$	
255-260	Sandstone, brown, fine-grained		1	350	<b>   </b>	
260-265	Siltstone, gray			}		
265-275	Sandstone, gray, fine- to medium-fine-grained			\$		
275-280	Sandstone, fine-grained; maroon shale		-	5 000		
280-295	Sandstone, gray, fine-grained		4	}		
295-300	Sandstone, gray, very fine grained, powdery					
300-335	Same as above		13	٤		
335-350	Siltstone to very fine grained sandstone, very hard			3 200		
350-365	Sandstone, white, fine-grained					
365-380	Siltstone, gray to dark-gray, carbonaceous			500		
380-395	Sandstone, fine-grained, well-indurated					
395-410	Sandstone, medium-grained			{		In the second seco
410-445	Shale, carbonaceous; sandstone, fine- to medium-grained, with carbona- ceous streaks		-	550		
445-465	Shale, dark-gray; dark-gray mudstone			\$	1	
465–495	Sandstone, medium-grained, with carbonaceous stringers throughout			3		
495-500	Mudstone, carbonaceous		. H		3	
500-550	Sandstone, medium-grained, with carbonaceous stringers			<i>3</i>		
550-605	Shale, carbonaceous, to carbonaceous siltstone			650	3	
	TOP OF CASTLEGATE SANDSTONE				3	
605-785	그는 마리아이 얼마나 있다면 되었다면 되었다면서 그렇지 않는데 하는데 하는데 하는데 하는데 하는데 하는데 하는데 하는데 하는데 하				$\begin{cases} \\ \end{cases}$	2 P 1
785-820	very clean TOP OF BLACKHAWK FORMATION Mudstone, carbonaceous, to carbona- ceous shale		<u> </u>	700	Fheid like	5
820-830	Mudstone, carbonaceous; coal stringers		-			
	49			5 756		

Hole No. BC-7-W

(continued)

	LITHOLOGY	G E		GEOPHY	SICAL LO	GS
	EIIIIOEOGI	STRIP	Gam	Den	Cal	Res
830–880 880–940 940–945 945–984	Shale and sandstone; some carbon ceous stringers  Sandstone, medium-grained, clean Coal. Sunnyside bed  Sandstone, medium-grained, clean Total depth: 985 ft	a-	Gall Control of Control of the Contr	300 S		Res
				930		
	w.					
			i			

Hole No.	BC-8-W Quadrangle Woodsid	e		Elevation	5,950	<u>Et</u>
Location	n: T. <u>17</u> S., R. <u>15</u> E., sec. <u>29</u>	, 700'	FSL 1.2	200' FWI.		1
Rotary-	Cored interval 771.3-ed depth 771.3'	942' L	Total	depth <u>942</u>		
Geophysi	ical logs:					
Ca1	liper (Cal) - Logging speed: 40 ft/min	. Ot	hers:	20 ft/min	n	
	sistivity (Res):			L5 Ω/log d	-	
Gan	nma (Gam): T.C. 1 sec.			20 cps/log		
Der	nsity (Den): T.C. 1 sec.			200 cps/lo		
Remarks:						
-			,			
	LITHOLOGY	G LIP		GEOPHY	SICAL LO	GS
	LITHOLOGI	STRIP	Gam	Den	Cal -	Res
0- 25	Sandstone, yellowish-brown		1	o'	7 6	
	TOP OF PRICE RIVER FORMATION		1	1		
35-140	Sandstone, yellowish-brown, fine- grained; minor siltstone and mudstone		9	50		
140-150	Mudstone, medium-gray, silty				1/1-1	
150–165	Sandstone, yellowish-brown, fine-grained			100		
165-170	Mudstone, dark-gray			<b>*</b> , ,	1	12 m
170-180	Sandstone, yellowish-brown				{	
180-190	Mudstone, medium-gray					
190-210	Sandstone, light-gray, fine-grained		-	150		
210-235	Mudstone, medium-gray				1	
235-245	Siltstone, light gray; mostly quartz		-	£		
245-255	Mudstone, dark-gray			3		
255-265	Siltstone, light-gray		-	200		•
265-270	Mudstone, medium-gray			3	1441-1	•
270-310	Siltstone and mudstone			3	2	
310-320	Mudstone, medium-gray			\$	13	THE STATE OF THE S
320-360	Siltstone, light-gray		F	\$250	1	
360-395	Mudstone, medium-gray				1	
395–405	Siltstone, light-gray					, re-

Hole No. BC-8-W (continued)

		LITHOLOGY	STRIP		GEOPHYS	ICAL LO	GS
		211101001	STS	Gam	Den	Cal	Re
405	-410	Carbonaceous shale, with minor coal		,	3		
410	-550	Mudstone, medium-gray; some carbonaceous material		American Commencer			
550	-570	Siltstone, medium-gray; carbona- ceous material		The state of the s	350		
570	-590	Mudstone, medium-gray		5	{	1	
590	-605	Siltstone, medium-gray		5		1	
		TOP OF CASTLEGATE SANDSTONE			400		
605	-740	Sandstone, light-gray, fine- grained; mostly quartz					
		TOP OF BLACKHAWK FORMATION				11	
740	745	Mudstone					+ + + + + + + + + + + + + + + + + + +
745	-755	Sandstone, fine-grained			450		
755	-771.3	Mudstone, carbonaceous; minor coal			3	3	H
		End rotary; begin core		-	3	}	
771.	3–795	Siltstone and mudstone, inter- bedded			500		
795	-800	Carbonaceous shale, with minor coal (as much as 0.1 ft)		***	}	15	
800	-800.8	Silty mudstone; abundant carbona- ceous material				}	
800.	8-811.4	Siltstone; some carbonaceous material; shows dark bands			350		
811.	4-812	Carbonaceous shale		P	<b>}</b>		
812	-812.1	Coal		T. W.			<del>-</del>
812.	1-812.5	Carbonaceous shale; abundant pyrite			600*		
812.	5-814.2	Silty mudstone; abundant carbona- ceous material		Jan			
814.	2-814.9	Carbonaceous shale, with minor coal		The state of the s	650		
814.	9-815.9	Silty mudstone; carbonaceous material		area hada			
815.	9-817.2	Carbonaceous shale, with minor coal		The state of the s	3		
817.	2-819.6	Mudstone; carbonaceous material		1	( )	11	
819.	6-819.8	Carbonaceous shale		4			
819.	8-822.8	Silty mudstone; carbonaceous material		5	<b>X</b>		

	LITHOLOGY	STRIP		GEOPHYS	SICAL LO	GS
	BIHOBOGI	STE	Gam	Den	Cal	Res
823.4-831.8 831.8-832.3 832.3-832.5 832.5-841.9 841.9-842.7 842.7-845.3 845.3-845.8 845.8-846.6 846.6-854.9 905.9-915 915 -917.9	Carbonaceous shale Siltstone, dark- to light-gray Coal Carbonaceous shale Siltstone, banded; some carbonaceous material Carbonaceous shale Siltstone, banded Coal Carbonaceous shale Siltstone and mudstone, interbedded Sandstone, fine-grained, friable; crossbedding; some dark gray beds Siltstone and mudstone, interbedded Coal. Sunnyside bed Siltstone, with minor coal Sandstone, gray, fine-grained; massive at top, crossbedded at bottom Total depth: 942.1 ft		Market And a forther than the standard of the	950		

Hole No	. BC-10-W Quadrangle Woods	ide	1	Elevation	5,700	ft
Locatio	on: T. 17 S., R. 15 E., sec. 29	700'	FSL 1,	150' FEL		V.
Rotary-		L	ogged de	epth <u>984'</u>	_ Total	depth 990
		negrum		id Todai		-
Geophys	sical logs:					
	liper (Cal) - Logging speed: 40 ft/min			$\frac{20}{16.7}$ ft/min $\frac{20}{16.7}$ $\Omega/\log 2$		
	esistivity (Res): T.C. 1 sec.			20 cps/log		
	ensity (Den): T.C. 1 sec.			00 cps/log		
Remarks		be				<del></del>
		1	,			
	LITHOLOGY	STRIP		СЕОРНУ	SICAL LO	OGS
		STI	Gam	Den	Cal -	Res
	Collared in North Horn Formation			ď	51	
0- 15	Siltstone, greenish-yellow					
	Siltstone, medium-gray				5	
40- 50	Shale, medium-gray		-	3	3	
	TOP OF PRICE RIVER FORMATION			50'	{	
50- 55	Sandstone, light-gray, fine-grained, friable		5		\$	· · ·
55- 65	Sandstone, yellow, medium-grained, well-rounded, friable					
65–115	Sandstone, white, poorly sorted, friable; subangular grains of quartz		5	100 4 4 8 7 16	\$	Market and an analysis of the second and
115-125	Sandstone, light-gray, fine-grained, quartzose, friable			<b>1 3 3 3 3 3 3 3 3 3 3</b>		
125-130	Sandstone, white, fine-grained, quartzose, friable			150	{	
130-135	Sandstone, light-yellowish-brown,				3	
	medium-grained, subrounded, friable		-	<b>4.</b>	3	
135-140	Shale, medium-gray				13	
140-145	Sandstone, yellow, medium-grained, subrounded, friable		. 5			*
145-170	Shale, medium- to dark-gray; pyritic at 155 ft		3	\$		
170-180	Sandstone, light-gray, fine-grained		=	250	3	
180-200	Shale, dark-gray; carbonaceous from 190 to 200 ft		_1			
				5-1-	3	

	LITHOLOGY	STRIP	GEOPHYSICAL LOGS				
	HIMODOGI	STE	Gam	Den	Cal	Res	
200–240	Sandstone, light-gray, very fine grained		1		1		
240-245	Shale, medium-gray		1				
245-250	Siltstone, light-brownish-gray			3		-	
250–265	Shale, medium-gray		-	350			
265–270	Sandstone and carbonaceous shale; sandstone is light gray and fine grained						
270-280	Shale, dark-gray, carbonaceous			3	3 1 1		
280-320	Shale, medium-gray		*	3 400			
320-330	Siltstone, light-gray		1	5	3		
330-340	Shale, medium-gray			1			
340–360	Silty sandstone, light-gray, very fine grained			450			
360-400	Shale, dark-gray, carbonaceous		- {				
400–405	Siltstone, light-gray, friable		4	, Š.	\$		
405-425	Shale, dark-gray, carbonaceous			}			
425–440	Shale, medium-gray, with some inter- bedded light-gray, fine-grained sandstone		E	500			
440–470	Shale, light-gray, with sandstone as above		3	<i>ξ</i> .			
470-475	Carbonaceous shale and sparse coal		1	550	1		
475-480	Carbonaceous shale			3	<b> </b>		
480–550	Shale, medium-gray, with light-gray, fine-grained sandstone, interbedded				3		
550–560	Sandstone, light-gray, very fine grained, angular			600'	1	<del>7</del> 8	
560-635	Shale, dark-gray to black		2	\$	}		
	TOP OF CASTLEGATE SANDSTONE		Ş		3		
635–650	Silty sandstone, light-gray, very fine grained, friable			650	}		
650–665	Sandstone, light-gray, poorly sorted, angular-grained; interbedded black shale		Harmon March Comment		A Cod	(e,v)	
665–790	Sandstone, light-gray, fine-grained, angular		and Lander	700		}	
	TOP OF BLACKHAWK FORMATION		The state of the s		1		
790–800	Coal and carbonaceous shale		the state of the s		3		
	55		3	750	1 3	7.0	

	LITHOLOGY	STRIP LOG		GEOPHYS	SICAL LO	GS
	LIINOLOGI	STE	Gam	Den	Cal	Res
800–805	Sandstone, light-gray, fine-grained, angular, with carbonaceous shale		To the second se		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	
805-815	Carbonaceous shale		2	, 3	3 3	5
815–830	Sandstone, light-gray, very fine grained, with interbedded carbonaceous shale and minor coaly material		Will Thomas	800		
830–835	Sandstone, light-gray, very fine grained, friable					<u> </u>
835-845	Carbonaceous shale		- 3	850	1	3
845–870	Sandstone, light-gray, medium-grained, with interbedded carbonaceous shale					
370–880	Sandstone, medium-gray, poorly sorted, subangular-grained		and the same	900		
880–890	Sandstone, light-gray, fine-grained, with interbedded carbonaceous shale		Variabelle Commence	300		
390–935	Sandstone, light-gray, fine-grained, with coaly specks from 930 to 935 ft		5		1	
935-940	Coal. <u>Sunnyside</u> bed		1	950		13 B 13 B 13 B
940–990	Sandstone, light-gray, fine-grained, subangular		4			
	Total depth of "E" log: 984 ft	Tribulari Vi	1		11 }	
	Service of the control of the contro					
		1	,			